

TON DUC THANG UNIVERSITY

FACULTY OF ELECTRICAL AND ELECTRONICS ENGINEERING

403040

Programmable Logic Controller

CHAPTER 1: INTRODUCTION TO PLC

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OBJECTIVES

- Understand sequence control.
- Remember origin & advantages of PLC.
- Know PLC families.
- Remember roles of components in SIMATIC system.

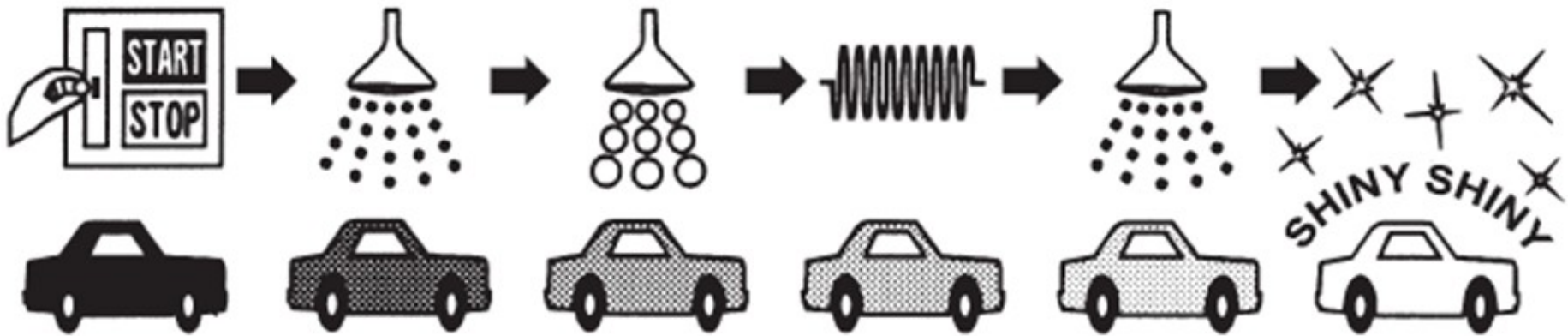
CHAPTER 1: INTRODUCTION TO PLC

- 1.1 Sequence control
- 1.2 Origin & advantages
- 1.3 PLC families

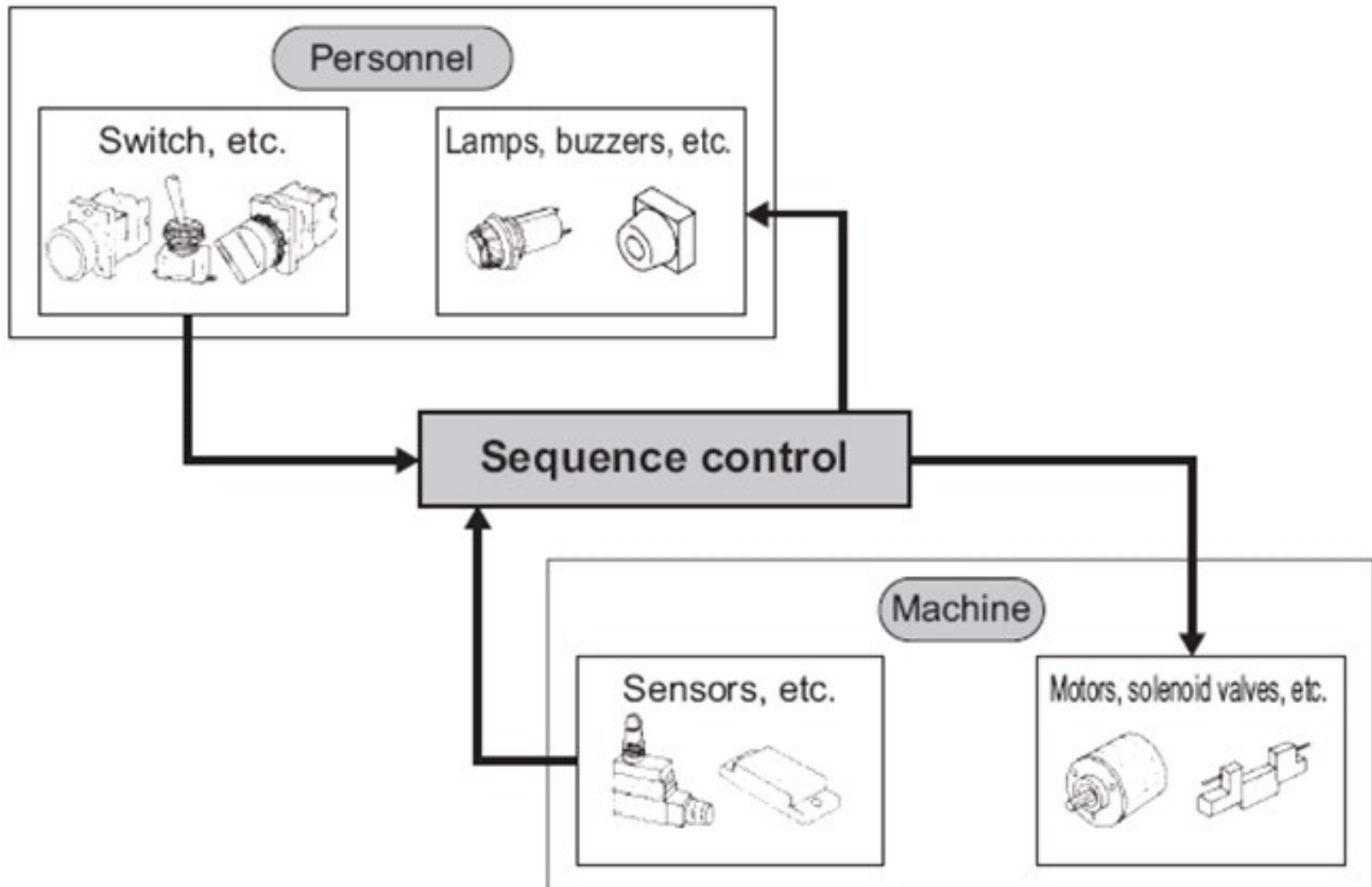
CHAPTER 1: INTRODUCTION TO PLC

- 1.4 SIMATIC system
 - 1.4.1 Controller
 - 1.4.2 Programming device
 - 1.4.3 PLC software
 - 1.4.4 Communication network
 - 1.4.5 HMI

1.1 SEQUENCE CONTROL



1.1 SEQUENCE CONTROL



1.1 SEQUENCE CONTROL

Devices in sequence control system:

- Devices are operated by human.
- Devices detect states of machines.
- Devices make machines operate.
- Devices inform human of states of machines.

1.2 ORIGIN & ADVANTAGES

- ❑ In 1968, General Motors brought out PLC design standard.
- ❑ In 1969, first programming controller was born at GM.
- ❑ In 1971, PLC was officially used to replace relay.
- ❑ ***Nowadays***, PLC appears in ***most of automation applications***.

1.2 ORIGIN & ADVANTAGES

- ❑ High reliability.
- ❑ Modularization, flexible in design & maintainance.
- ❑ Flexible programming language.
- ❑ Fast computing ability.
- ❑ Easy network connecting ability.
- ❑ Fault diagnosing & breakdown detecting

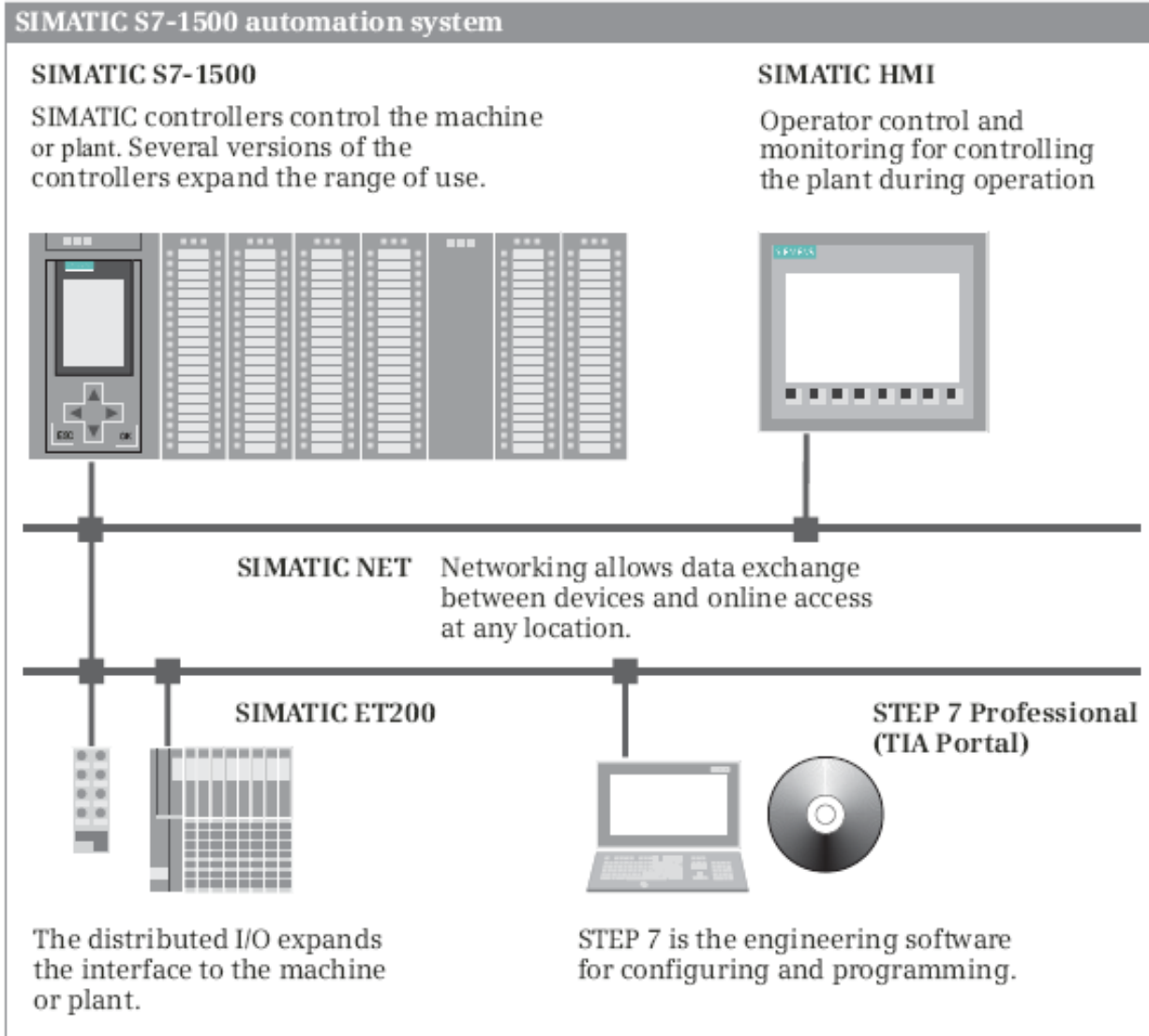
1.3 PLC FAMILIES



PAC or Industrial PC? Plug-in modules, reusable code, a common OS - and Intel processors typify the GE Fanuc approach

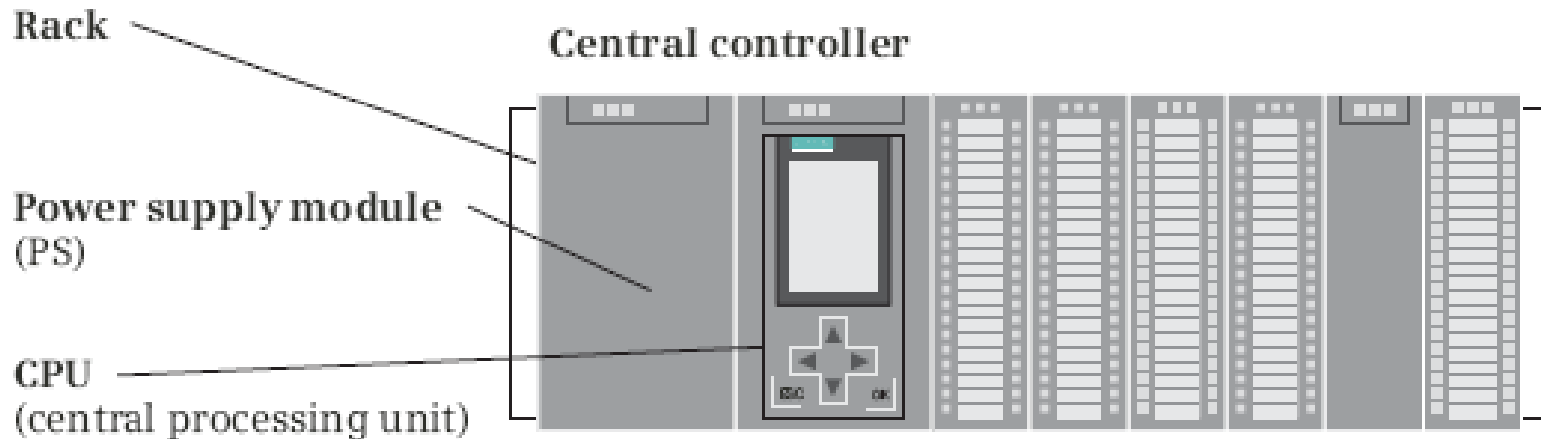


1.4 SIMATIC SYSTEM



1.4.1 CONTROLLER

Components of an S7-1500 controller



Can be plugged onto the rack:

Signal modules
(SM)

Technology modules
(TM)

Communication modules
(CM)

The rack has 32 slots. An optional power supply occupies slot 0 and the CPU occupies slot 1. To the right of the CPU, there is room for up to 30 modules (including power supply modules).

1.4.1 CONTROLLER

□ 3 versions of standard design

controllers:

- CPU 1511-1 PN
- CPU 1513-2 PN



- CPU 1516-3 PN/DP

1.4.1 CONTROLLER

- Possible to connect to Industrial Ethernet using PN interface.
- Each CPU can be both IO controller and “intelligent” IO device on PROFINET IO.

1.4.1 CONTROLLER

	CPU 1511-1 PN	CPU 1513-2 PN	CPU 1516-3 PN/DP
User memory Work memory for program for data Retentive memory Load memory on the memory card up to	150 KB 1 MB 128 KB 2 GB	300 KB 1.5 MB 128 KB 2 GB	1 MB 5 MB 128 KB 2 GB
Hardware configuration Racks Modules per rack	1 max. 32	1 max. 32	1 max. 32
Address ranges in the process image per IO subsystem	32 KB inputs, 32 KB outputs 8 KB inputs, 8 KB outputs	32 KB inputs, 32 KB outputs 8 KB inputs, 8 KB outputs	32 KB inputs, 32 KB outputs 8 KB inputs, 8 KB outputs

1.4.1 CONTROLLER

	CPU 1511-1 PN	CPU 1513-2 PN	CPU 1516-3 PN/DP
Blocks			
Number (total)	2000	2000	6000
OB/FB/FC size	150 KB	300 KB	512 KB
DB size	1 MB	1.5 MB	5 MB
Bit memory	16 KB	16 KB	16 KB
SIMATIC timers	2048	2048	2048
SIMATIC counters	2048	2048	2048
Temporary local data			
per priority class	64 KB	64 KB	64 KB
per block	16 KB	16 KB	16 KB

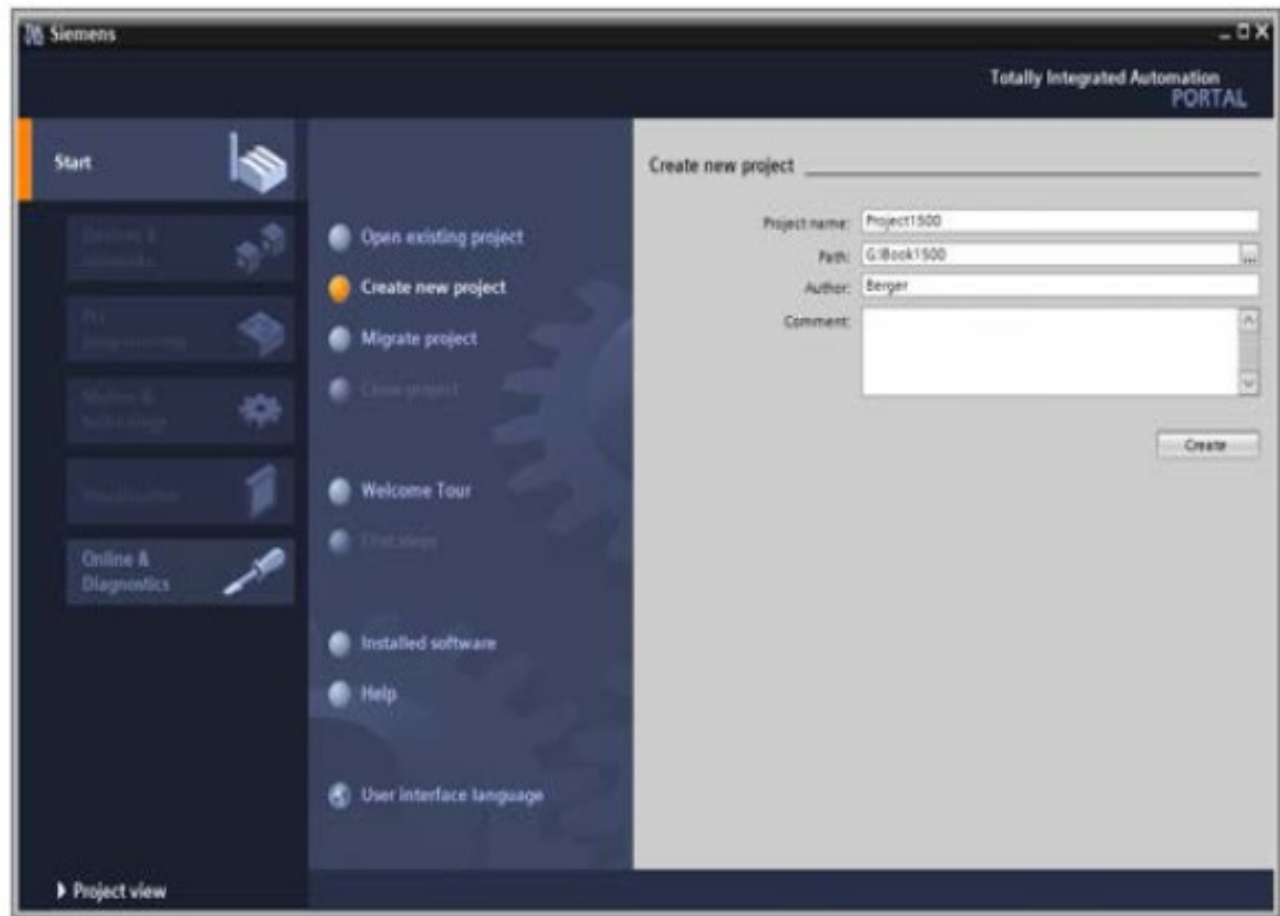
1.4.1 CONTROLLER

	CPU 1511-1 PN	CPU 1513-2 PN	CPU 1516-3 PN/DP
Interfaces			
PROFINET	1 (IO controller/device)	1 (IO controller/device)	1 (IO controller/device) 1 (Industrial Ethernet)
PROFIBUS	–	–	1 (DP master)
Interfaces via CM	4 (PROFINET + PROFIBUS)	6 (PROFINET + PROFIBUS)	8 (PROFINET + PROFIBUS)
Number of connections			
maximum	96	128	256
reserved for PG, HMI, and Web server	10	10	10
via integrated interfaces	64	88	128
Execution times			
for binary operations	60 ns/statement	40 ns/statement	10 ns/statement
for word operations	72 ns/statement	48 ns/statement	12 ns/statement
for fixed-point arithmetic	96 ns/statement	64 ns/statement	16 ns/statement
for floating-point arithmetic	384 ns/statement	256 ns/statement	64 ns/statement

1.4.2 PROGRAMMING DEVICE

- Personal Computer.
- Industrial PC.
- Notebook + Microsoft Windows
operating system.

1.4.3 PLC SOFTWARE

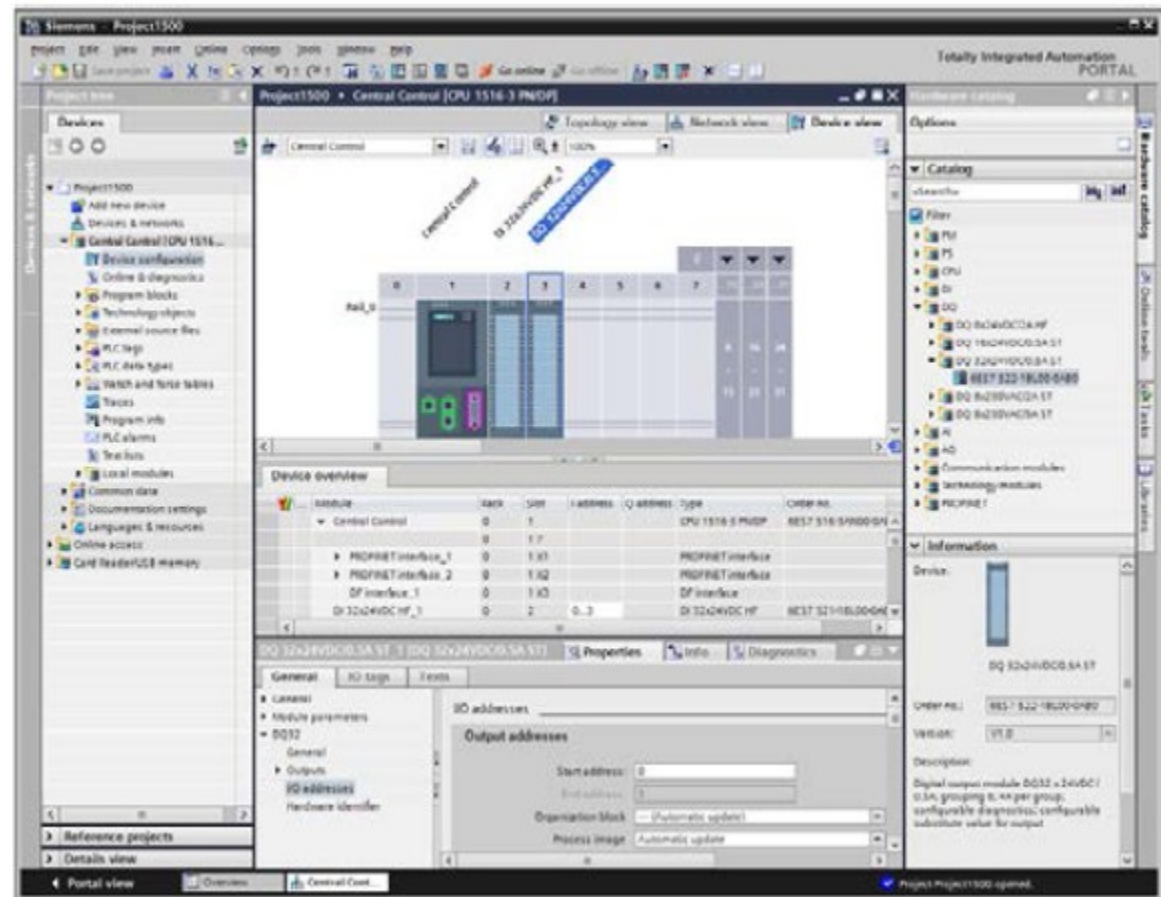


STEP 7 Software configures, parameterizes & programs SIMATIC components

1.4.3 PLC SOFTWARE

TIA Portal (TIA = Totally Integrated Automation):

central tool for managing automation data & associated editors in form of **hierarchically structured**



SIMATIC NET (PROFIBUS, PROFINET)
handles exchange of data via various
bus systems between SIMATIC
controllers, distributed I/O, HMI devices
& programming device.

1.4.5 HMI

SIMATIC HMI (Human Machine Interface):
control, monitor machine/plant & its function.

Provide control functions via process images, display system status & alarm messages, and manage automation data in form of recipes or measured value

- Sequence control
- Origin & advantages of PLC
- PLC families

ASSIGNMENT

- Read [1]: 23-46, 86-134.
- Read [2]: 34-47, 15-33.